

PATENT ABSTRACTS OF JAPAN

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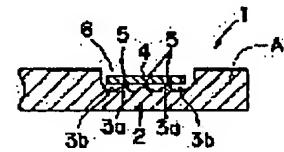
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(54) ELECTRODE PLATE FOR BATTERY AND MANUFACTURE THEREOF

(57)Abstract:

PROBLEM TO BE SOLVED: To strongly weld a lead piece to a compressed plate part formed in an electrode plate by forming recessed and projecting parts on the plate surface of the compressed part, where a lead wire is welded, of the electrode plate, and welding the lead piece to the projecting part.

SOLUTION: A recessed and projecting surface 3 comprising a plurality of projecting parts 3a and recessed parts 3b is formed on the plate surface of a compressed plate part 2 formed by compressing the one side of the peripheral part of a porous electrode substrate A in which an active material is filled, and a lead piece 4 is welded at a welded part 5 to the projecting part 3a of the recessed and projecting part 3 to constitute a battery electrode plate 1. Although the welding of the lead piece 4 to the recessed and projecting part 3 is performed by spot welding or ultrasonic welding, since the lead piece is welded to the projecting part 3a, stable, strong welding is performed by weak pressure, and the peeling off strength of the lead piece 4 from the welded part 5 is increased.



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CLAIMS

[Claim(s)]

[Claim 1] The plate for cells which forms this compression Itabe's plate surface in a concave convex, welds the piece of a lead to the heights of the concave convex, and grows into them in the plate for cells which welds the piece of a lead to compression Itabe who formed at least in one side of the side edge of a plate, and grows into him.

[Claim 2] an active material -- the manufacturing method of the plate for cells characterized by welding the piece of a lead to the heights of this concave convex of this compression Itabe after carrying out pressurization compression at least of one side of the side edge of the porous electrode substrate which it filled up with the mixture or is not carried out with the fixture for press formed in the concave convex in the press side and forming compression Itabe's plate surface in a concave convex.

[Claim 3] an active material -- the manufacturing method of the plate for cells according to claim 2 characterized by to weld the piece of a lead to the heights of one of this concave convex of these compression Itabe after carrying out pressurization compression of both sides of the side edge of this porous substrate that it filled up with the mixture or is not carried out by the pair of the fixture for press formed in the concave convex in the press side and forming both compression Itabe's edge surfaces in a concave convex.

[Claim 4] an active material, after carrying out pressurization compression at least of one side of a porous metal substrate which has the extensive area which is sufficient for manufacturing the plate of at least two sheets which it filled up with the mixture or is not carried out by cutting with the fixture for press which has a flat press side and forming compression Itabe By rolling out this substrate through a pressure roll, this compression Itabe's flat plate surface is formed in a wave-like concave convex. The manufacturing method of the plate for cells characterized by forming two or more porous electrode substrates which have compression Itabe who cuts next in this compression Itabe's pars intermedia, and has a wave-like concave convex at a side edge, and welding the piece of a lead to the heights of the concave convex of the shape of a wave of compression Itabe of each of that porous electrode substrate.

[Claim 5] The manufacturing method of the plate for cells according to claim 3 characterized by pressurizing both sides of the predetermined part of the porous electrode substrate which uses the pair of this fixture for press according to claim 4, and has the above-mentioned extensive area by this.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the manufacturing method at the plate list for cells.

[0002]

[Description of the Prior Art] The pasted electrode used for alkaline batteries, such as the conventional nickel-cadmium battery and a nickel hydride battery, welds the piece of a lead to compression Itabe formed at least in one side of the side edge, grows into him, and by this compression Itabe, it takes out the electrical and electric equipment from the piece of a lead welded to this while making conductivity and a mechanical strength improve. One example of the production process is shown in drawing 11 . Drawing 11 (a) pressurizes at least the one side with the fixture B for press which has the flat press side b of **12** in the side edge of the porous nickel electrode substrate A which consists for example, of foaming nickel, and forms compression Itabe a. a degree -- this porous electrode substrate A -- for example, positive active material -- after being filled up with a mixture and drying, drawing 11 (c) and the paste type electrode plate P of **13** are obtained by carrying out welding D of spot welding or ultrasonic welding next by pressurizing with a pressure roll and preparing in predetermined thickness in the piece C of a lead which consists of the griddle which performed a nickel plate or nickel plating to this compression Itabe a. in addition, an active material -- the active material with which the desiccation front stirrup adhered to this compression Itabe's a front face behind after being filled up with the mixture -- a mixture -- brushing -- or blasting of water or air removes.

[0003]

[Problem(s) to be Solved by the Invention] Since the above-mentioned conventional plate P for cells carries out welding D of the piece C of a lead to this compression Itabe's a flat side, its peel strength of the weld zone D is comparatively small. Therefore, external force has often exfoliated [***** and this piece C of a lead] in the piece of a lead in routings, such as the erector of a group of electrode degree, and they have the problem which produces a manufacture loss. Moreover, since this compression Itabe a compresses the porous electrode substrate A with high porosity, a mechanical strength may be comparatively small and the force may produce ***** , a **** crack, and fracture to the erector of a group of electrode degree etc. moreover, the above-mentioned manufacturing method -- setting -- an active material -- in this compression Itabe's a

outside after being filled up with a mixture Since the compression crevice which uses this compression Itabe's flat plate surface as a base is formed of the pressurization compression by this fixture B for press the active material which adhered all over the flat base of the compression crevice which should weld the piece C of a lead -- the active material with which clarification removal of the mixture had to be carried out completely, and the activity was troublesome with the active material and often remained -- there was un-arranging [which a mixture interferes with welding with the piece C of a lead, and brings about poor welding].

[0004]

[Means for Solving the Problem] It is what offers the strong stable plate for cells which brings about the increase of the peel strength of the weld zone of the piece of a lead and the improvement in compression Itabe's reinforcement which this invention solved the above-mentioned technical problem, and were welded to compression Itabe. In the plate for cells which welds the piece of a lead to compression Itabe who formed at least in one side of the side edge of a plate, and grows into him, this compression Itabe's plate surface is formed in a concave convex, and the piece of a lead is welded to the heights of the concave convex, and it grows into them.

[0005] It is what offers the manufacturing method of one plate for cells which can make removal of a mixture easy. furthermore -- while this invention brings about the plate of above-mentioned this invention -- an active material -- an active material -- after carrying out pressurization compression at least of one side of the side edge of the porous substrate which it filled up with the mixture or is not carried out with the fixture for press formed in the concave convex in the press side and forming compression Itabe's plate surface in a concave convex, it is characterized by welding the piece of a lead to the heights of this concave convex of this compression Itabe.

[0006] In this manufacturing method, by the pair of this fixture for press, by carrying out pressurization compression of both sides of the edge section of that porous substrate, if both compression Itabe's plate surfaces are formed in a concave convex, increase of much more mechanical strength is brought about, and one concave convex of both that compression Itabe's plate surfaces can be used for welding of the piece of a lead.

[0007] It is what offers the manufacturing method of other one plate for cells which can make removal of a mixture easy. furthermore -- while this invention brings about the plate for cells of above-mentioned this invention -- an active material -- an active material, after carrying out pressurization compression at least of one side of a porous metal substrate which has the extensive area which is sufficient for manufacturing the plate of at least two sheets which it filled up with the mixture or is not carried out by

cutting with the fixture for press which has a flat press side and forming compression Itabe By rolling out this substrate through a pressure roll, this compression Itabe's flat plate surface is formed in a wave-like concave convex. Two or more porous electrode substrates which have compression Itabe who cuts next in this compression Itabe's pars intermedia, and has a wave-like concave convex at a side edge are formed, and it is characterized by welding the piece of a lead to the heights of the concave convex of the shape of a wave of compression Itabe of each of that porous electrode substrate.

[0008] In this case, if the pair of this fixture for press is used, both sides of the predetermined part of the porous electrode substrate which has the above-mentioned extensive area by this are pressurized and a wave-like concave convex is formed in both that compression Itabe's plate surfaces, one wave-like concave convex of both that plate surface can be used for welding of the piece of a lead:

[0009]

[Embodiment of the Invention] Next, the example of this invention is explained with reference to an accompanying drawing. Drawing 1 thru/or drawing 4 show one example of the manufacturing method of the plate for cells of this invention applied mainly to an alkaline battery, and one example of the plate for cells obtained by this. Drawing 1 (a) and (b) show the production process Fig. showing the manufacturing method of the plate for this invention cells. Drawing 1 (b) shows the top view of the plate 1 for cells of the shape of a rectangle of this invention, and drawing 4 shows the IV-IV line cutting side Fig. The plate 1 for cells of this invention forms the plate surface of compression Itabe 2 who did pressurization compression and formed one side of the side edge of the porous electrode substrate A filled up with the active material in the concave convex 3 which consists of two or more heights 3a and crevice 3b, in heights 3a of the concave convex 3, carries out the piece 4 of a lead welding 5, and constitutes it so that clearly from these drawings. Although welding in this concave convex 3 of the piece 4 of a lead is welded by spot welding, ultrasonic welding, etc. Since it is welded to the heights 3a, while it compares with conventional flat compression Itabe's plate surface welding to a flat side and the welding pressure per unit area increases Since current density also increases, strong welding also with stable ** is obtained with small welding pressure, and the peel strength of the weld zone 5 of the piece 4 of a lead increases, does not have generating of poor welding like before, and may be manufactured by high efficiency without the loss of a product. Although this piece 4 of a lead consists of the piece of a strip of a narrow width by metal closing in made from nickel etc. and the end section is welded by this compression Itabe's 2 concave convex 3 Like **4**, since the edge is held in the compression crevice space 6 which uses as a base this concave convex 3 formed in

this compression Itabe's 2 outside and does not project outside from the 1st page of this plate, it does not damage the separator by which a laminating is carried out to the 1st page of the plate by this piece 4 of a lead.

[0010] two or more ridges where this concave convex 3 is parallel to drawing 3 and drawing 4 like designation -- it consists of the groove crevices 3b and 3b which are parallel to heights 3a of a **, and 3a-- between them. The porous electrode substrate with which formation of this concave convex 3 has the continuation fine hole of the three-dimensional structure of about 95% or more of porosity of conductive felt-like electrode substrates, such as carbon fiber metallurgy group fiber, a foaming nickel electrode substrate, etc. in the production process of the above-mentioned plate, In the example of illustration, the press side 7 which shows one side of the side edge of a foaming nickel substrate to drawing 2 by carrying out pressurization compression with the press fixture 8 of the rectangular parallelepiped formed in the concave convex 7 in which protruding line 7a and concave streak 7b of cross-section triangle Yamagata were formed in parallel with alternation drawing 3 -- designation -- like -- the ridge of the above [this compression Itabe's 2 plate surface] -- it is formed in the concave convex 3 to which heights 3a of a ** and groove crevice 3b were parallel by turns, and the crevice space 6 where the side veranda was opened wide similarly on the outside is obtained. next -- the electrode substrate A of this plate 1 -- a conventional method -- the production process -- an active material -- a mixture -- a spreading restoration machine -- an active material -- it fills up with the mixture. for example, the active material which kneaded with viscous agent water solutions, such as CMC, to what made the subject positive-active-material powder which consists of nickel hydroxide powder, and mixed nickel powder and cobalt powder as an electric conduction agent in order to have manufactured the positive-electrode plate, and was prepared to it -- it is filled up with a mixture. In addition, the fixture 8 for press is used in use through connection lever 8a which protruded from now on, connecting with the body of a pressurization machine which is not illustrated.

[0011] this compression Itabe's 2 front face -- an active material -- since the mixture has adhered -- a degree -- an active material -- before carrying out stoving of the electrode substrate A filled up with the mixture, blasting of brushing, water, or the compressed air removes an adhesion active material behind. According to this invention, the plate surface 3 of the side into which this compression Itabe 2 was compressed Since it is sufficient if it is the aforementioned concave convex configuration and ** also welds the piece 4 of a lead only to the heights 3a since then Since it does not have a bad influence on welding of the piece 4 of a lead at all even if it is sufficient if an adhesion active

material is removed only from the heights 3a and 3a, and an active material remains to the crevice When conventional compression Itabe's plate surface is a flat side, it can compare, when clarification of the whole surface needs to be carried out, and a clarification activity can be done easily and quickly, and it is desirable.

[0012] in this way -- since then and a conventional method -- following -- a restoration active material -- after performing stoving of a mixture, the plate 1 of this invention is obtained for the piece 4 of a lead good like drawing 1 (b) and **4** by welding the piece 4 of a lead to the compression Itabe's 2 concavo-convex plate surface 3. in addition, welding to this compression Itabe 2 of this piece 4 of a lead -- an active material -- of course, you may carry out at the front like the packer of a mixture

[0013] in addition -- again -- an active material -- a mixture is pressurized through the pressure roll of a pair before welding of the aforementioned piece 4 of a lead, after finishing restoration and desiccation processing, and although it is general to adjust this substrate in predetermined thickness, even if it pressurizes through a pressure roll after welding of the piece 4 of a lead, it does not interfere.

[0014] According to this invention, of course, you may constitute in the plate 1 to which pressurization compression of both sides of the side edge of the porous electrode substrate A of this plate 1 was carried out, the concave convexes 3 and 3 were formed in compression Itabe's 2 both sides, and the piece 4 of a lead was welded by heights 3a of one of the concave convexes 3. Drawing 5 (a) shows one example of the manufacturing method, and drawing 5 (b) is the decision Fig. of the important section corresponding to drawing 4 of the example of the point of the plate A obtained by this. As the manufacturing method is shown in drawing 5 (a), in the example of illustration, the fixtures 8 and 8 for press of the format formed in the concave convex 7 which has by turns protruding line 7a to which a large number are parallel in the press side used in the previous example, and concave streak 7b to both sides of the side edge of this porous electrode substrate A It arranges in a location where concave streak 7b gears with each protruding line 7a which the press sides 7 and 7 which counter counter up and down through this substrate A, and pressurization compression is carried out so that both sides of the side edge of this substrate A may be compressed with the fixtures 8 and 8 for these press. At the appropriate time, it compares with conventional flat compression Itabe a, and a mechanical strength increases, compression Itabe 2 crooked **** of **5** and in the shape of a wave is obtained, even if it receives external force in the assembly operation of a group of electrode etc., raw [of a crack or the damage] is not carried out, but a strong stable plate is obtained. the ridge which is parallel to coincidence like [the both sides] an example 1 with compression Itabe 2 of the shape of the wave -- the

compression crevice space 6 is formed in each of the outside at the same time the ** heights 3a and 3a, and the groove crevices 3b and 3b and the concave convexes 3 and 3 which -- has by turns are formed. [--, and] In this way, the plate 1 of this invention is obtained by welding the piece 4 of a lead to the heights 3a and 3a of the concave convex 3 of the either of these compression Itabe 2, and -- before welding of the piece 4 of a lead -- this porous electrode substrate A -- an active material -- restoration of a mixture, and the active material adhering to this compression Itabe 2 -- although it is general to remove a mixture and it is desirable -- after welding of the piece 4 of a lead -- an active material -- even if it is made to be filled up with a mixture, it does not interfere.

[0015] Drawing 6 shows the modification of fixture 8' for press used for manufacture of the plate of this invention. This fixture 8' that has connection lever 8a' carries out alignment arrangement of punctiform heights 7a' of the shape of much square spindle, and the 7a for the press side in all directions. It forms in heights 7a' of the shape of each [these] spindle, 7a', and concave convex 7' of -- that punctiform crevice 7b' of the shape of much square spindle and 7b'-- are formed, and changes in between. The pair of fixture 8' for press with a ***** irregularity side configuration is prepared. In the way of **5** of a previous example By carrying out pressurization compression of both sides of the side edge of the porous electrode substrate A, like **7** To compression Itabe's 2 both sides At the same time the concave convexes 3 and 3 by which **** formation of much square spindle-like punctiform heights 3a and 3a and -- was carried out with punctiform heights 7a' of the shape of a square spindle of press side 7' of this fixture 8for press ' and 8', 7a', --, the square spindle-like punctiform crevices 7b and 7b, the punctiform crevices 3b and 3b of the shape of the square essence corresponding to -- and -- are formed The compression crevice space 6 and 6 is formed in the outside. It **, one concave convex 3 of the compression Itabe 2 is used, and the plate of this invention is obtained by welding the piece of a lead (not shown) to the heights 3a and 3a and --.

[0016] When the above carries out pressurization compression of the fixture for press currently formed in the concave convex in the press side at the piece edge of this porous electrode substrate A, as for the activity which forms compression Itabe with the concave convex, it is desirable to apply to the long picture which usually has the extensive area which is sufficient for manufacturing the plate of this invention of at least two sheets by cutting, or/and the double-width porous electrode substrate A. That is, it is desirable from the point of productive efficiency to consist predetermined spacing and to form compression Itabe who consists predetermined spacing along the side edge of the straight side of the porous electrode substrate A, does sequential pressurization compression at least of the one side with this fixture for press, and has a

concave convex.

[0017] Drawing 8 shows other examples of the manufacturing method of the plate of this invention. In this manufacturing method, compression Itabe who has a concave convex in this porous electrode substrate A can be formed, without using the fixture for press formed in the concave convex in the press side used for the above-mentioned example. That is, a long picture or/and a double-width porous electrode substrate with the extensive area which is sufficient for obtaining the electrode of this invention of at least two sheets by cutting are prepared. The porous electrode substrate A of the magnitude which has the predetermined width of face of the long picture which is sufficient for obtaining the electrode of this invention of two sheets by cutting like the drawing 8 (a) ** is prepared. For example, like the drawing 8 (b) ** In obtaining the plate of the predetermined magnitude of two sheets which cuts in the part shown by the imaginary line, and makes the cutting plane one side, respectively With the fixture 10 for press with the flat press side 9 with the area for two sheets equivalent to forming compression Itabe for two sheets which intersect perpendicularly with the imaginary line which should cut the schedule, and should be formed in the side edge of each plate of cutting of **9** At least one side of the substrate is intersected perpendicularly to the imaginary line which should be cut, and pressurization compression of the area over division into equal parts is carried out. 10a shows the connection lever formed in this fixture 10 for press. In the example of illustration, from both sides of the electrode substrate A, the pair of this fixture 9 for press is used, pressurization compression is carried out from the upper and lower sides, and the compression crevice space 6 of one long rectangle surrounded by non-compressed substrate thickness is formed in compression Itabe 2 who changes from the flat plate surface region for two sheets of the long rectangle for two **** of drawing (a) ** to the both sides, and its outside. a degree -- this electrode substrate A -- positive active material -- after being filled up with a mixture and drying, pressurization expanding is carried out in the die-length direction through the reduction roll of a pair. the difference of rolling with the substrate with which a reduction roll rolls out directly at the appropriate time, and this compression Itabe 2 that is not directly rolled out by the reduction roll -- this compression Itabe's 2 flat side -- **** of the drawing 8 (b) ** and **10** -- the concave convexes 3 and 3 of the shape of the shape of a wave and a wrinkle which consist of cross-section radii-like protruding line 3a to which a large number are parallel, respectively, and concave streak 3b are formed in the both sides crooked wavelike. The compression crevice space 6 and 6 is formed in both the compression Itabe's 2 outsides at coincidence. Next, when the cutting plane line of the schedule cuts, as shown in drawing 8 (c), the electrode

substrate A with which it filled up with the active material with which both sides of compression Itabe 2 of the shape of an above wave were formed in the side edge of the electrode substrate A at the concave convexes 3 and 3 is obtained. an active material -- this compression Itabe's 2 shaping front stirrup performs restoration to this electrode substrate A of a mixture behind. the active material which ** and has adhered to the front face of this compression Itabe 2 of each of that electrode substrate A in any case -- after removing a mixture, the plates 1 and 1 of this invention of two sheets are obtained by welding the piece 4 of a lead to the protruding line 3a and 3a of one of the concave convexes 3, i.e., heights, and --.

[0018] in addition, the active material to a porous metal substrate -- it cannot be overemphasized that it may be performed before restoration of a mixture forms compression Itabe with the concave convex of this invention, pressurization compression of after that [part] may be carried out, and compression Itabe may be formed. moreover, welding of the piece of a lead -- the electrode substrate A -- an active material -- next any are sufficient as the front stirrup filled up with a mixture.

[0019]

[Example] Next, a still more detailed example is explained.

Many punctiform heights and crevices were arranged in the side edge of the porous electrode substrate which consists of the sponge-like nickel sheet of 1.6mm in example 1 thickness, and 95% of 13mmx37mm porosity in the press side. the active material which added the CMC water solution of the specified quantity and agitated 93% of nickel hydroxide powder, 4% of cobalt powder, and 3% of nickel powder by the weight ratio after carrying out pressurization compression of the both sides with the fixture for press and forming **** in the both sides from many punctiform heights and punctiform crevices with 3mmx3mm compression Itabe -- a mixture -- this electrode substrate was filled up with the paste with the restoration machine, and it carried out stoving at 150 degrees C. The plate prepared in thickness of 0.55mm through the reduction roll of a pair at ** was obtained. the active material which carried out brushing of one concave convex of the compression Itabe next, and has adhered -- after removing a mixture, spot welding of the piece of a lead of the shape of a tape made from nickel with a thickness of about 0.15mm was carried out to the heights, and the plate of this invention was obtained.

[0020] The core was intersected in the line which should be cut since then [of the core of the die length of the porous electrode substrate which consists of 1.6mm in example 2 thickness, and a 13mmx74mm sponge-like nickel sheet], pressurization compression of both sides of this electrode substrate was carried out using the pair of the fixture for

press which has a 6mmx3mm flat press side, and compression Itabe who has a 3mmx3mm area equally to the both sides of the center line was formed. then, the positive active material same to this electrode substrate as an example 1 -- it was filled up with the mixture and dried. a degree -- the substrate of this long picture -- the die-length direction -- the reduction roll of a pair -- letting it pass -- pressurization extension processing -- carrying out -- this -- flat compression Itabe was made crooked in the shape of a wave, and the concave convex which has many wrinkles in the both sides was generated. Next, the compression Itabe's center line cut and the electrode substrate with which it filled up with the active material of two sheets with which compression Itabe of the shape of this wave was formed in the side edge was obtained. the active material which has adhered to one wavelike concave convex of these compression Itabe of each of that substrate next -- after removing a mixture by brushing, the piece of a lead was welded to the heights, and the plate of this invention was obtained.

[0021] It replaced with the fixture for press which made the concave convex the press side in the conventional example example 1, and the conventional plate was obtained like the example 1 except having used the fixture for press with the conventional flat press side.

[0022] Next, the peel test of the piece of a lead per each 100 plates of the above-mentioned examples 1 and 2 and the conventional example was performed. This peel test measured welding reinforcement in simple according to the hauling force when tearing off and fracturing the piece of a lead, and a plate. (news publication issue Okuda ***** from reference works "a guide to spot welding" 134 or 135 pages) . In the plate, five sheets were the defectives not more than tensile strength 11.8N conventionally. Incidentally, the average tensile strength of 100 sheets was 19.6Ns. On the other hand, the tensile strength of all the plates of this invention was large, and the defective was 0. Incidentally, the tensile strength of an average of 100 sheets each was 21.6Ns.

[0023]

[Effect of the Invention] Since according to this invention the plate surface of compression Itabe of the plate which should weld the piece of a lead is formed in a concave convex and the piece of a lead is welded to the heights, it compares with welding the piece of a lead to conventional compression Itabe's flat side, since current density also concentrates ** on heights with small welding pressure, welding is obtained certainly, and the plate welded more firmly is obtained. Moreover, compression Itabe who has a wrinkle-like concave convex automatically by being able to form easily or rolling out this electrode substrate after forming flat rectangle-like compression Itabe to a long substrate by carrying out pressurization compression of the porous electrode

substrate side with the fixture for press with which the compression Itabe's concave convex formed the press side in the concave convex is obtained. ** the heights of compression Itabe's concave convex -- blasting of brushing, air, or water -- an adhesion active material -- since it is sufficient if a mixture is removed, the removal serves as easy and high efficiency.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1 (a), (b)] The top view showing the production process of one example of the manufacturing method of the plate for cells of this invention.

[Drawing 2] The slant-face Fig. of the fixture for press used for the manufacturing method of this invention.

[Drawing 3] The slant-face Fig. of the important section enclosed with O of drawing 1 (a).

[Drawing 4] The IV-IV line cutting side Fig. showing one example of the plate for cells of this invention of the drawing 1 (b) **.

[Drawing 5 (a)] The sectional view showing a part of production process in the modification of the manufacturing method of this invention.

[Drawing 5 (b)] The sectional view of the important section of the plate for this invention cells pass the production process of drawing 5 (a).

[Drawing 6] The slant-face Fig. of the modification of the fixture for press.

[Drawing 7] The slant-face Fig. of the important section corresponding to drawing 3 which is some processes of the production process in the modification of the manufacturing method of this invention.

[Drawing 8 (a) - (d)] The top view showing the production process of other manufacturing methods of this invention.

[Drawing 9] The slant-face Fig. of the fixture for press used by the manufacturing method of **8**.

[Drawing 10] X-X-ray cutting side Fig. of drawing 8 (d) showing the electrode for cells of this invention.

[Drawing 11 (a) - (c)] The top view showing the production process of the manufacturing method of the conventional plate for cells.

[Description of Notations]

A Electrode substrate 1 Plate for cells of this invention 2 Compression Itabe

3 Concave Convex 3a Heights 3B Crevice

4 Piece of Lead 5 Welding 6 Crevice Space

7 7' Press side in which the concave convex was formed

8 8' Fixture for press 9 Flat press side 10 Fixture for press

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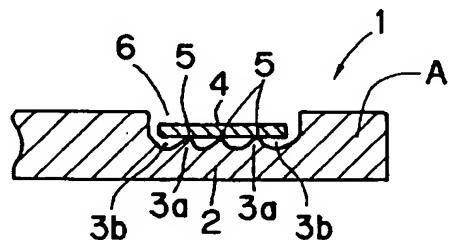
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(54)【発明の名称】 電池用極板並びにその製造法

(57)【要約】

【課題】 電極基板に設けた圧縮板部に、リード片を強固に溶接された電池用極板を提供する。

【解決手段】 多孔性電極基板Aの辺縁部に、凹凸面3を有する圧縮板部2を形成し、該凹凸面3の凸部3aにリード片4を溶接5する。



【特許請求の範囲】

【請求項1】 極板の辺縁部の少なくとも片面に形成した圧縮板部にリード片を溶接して成る電池用極板において、該圧縮板部の板面を凹凸面に形成し、その凹凸面の凸部にリード片を溶接して成る電池用極板。

【請求項2】 活物質合剤の充填された又はされてない多孔性電極基板の辺縁部の少なくとも片面を押圧面を凹凸面に形成された押圧用治具により加圧圧縮して圧縮板部の板面を凹凸面に形成した後、該圧縮板部の該凹凸面の凸部にリード片を溶接することを特徴とする電池用極板の製造法。

【請求項3】 活物質合剤の充填された又はされていない該多孔性基板の辺縁部の両面を、押圧面を凹凸面に形成された押圧用治具の一対により加圧圧縮して、圧縮板部の両縁面を凹凸面に形成した後、該圧縮板部のいずれか一方の該凹凸面の凸部にリード片を溶接したことを特徴とする請求項2記載の電池用極板の製造法。

【請求項4】 活物質合剤の充填された又はされていない少なくとも2枚の極板を切断により製造するに足る広面域を有する多孔性金属基板の少なくとも片面を平坦な押圧面を有する押圧用治具により加圧圧縮して圧縮板部を形成した後、該基板を加圧ロールを通して圧延することにより、該圧縮板部の平坦な板面を波形の凹凸面に形成し、次で該圧縮板部の中間部で切断して辺縁部に波形の凹凸面を有する圧縮板部を有する多孔性電極基板を複数枚形成し、その各多孔性電極基板の圧縮板部の波状の凹凸面の凸部にリード片を溶接することを特徴とする電池用極板の製造法。

【請求項5】 請求項4記載の該押圧用治具の一対を使用し、これにより上記の広面域を有する多孔性電極基板の所定個所の両面を加圧することを特徴とする請求項3記載の電池用極板の製造法。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】 本発明は、電池用極板並びにその製造法に関する。

【0002】

【従来の技術】 従来のニッケル-カドミウム電池、ニッケル水素電池等のアルカリ蓄電池に使用されるペースト式極板は、その辺縁部の少なくとも片面に形成された圧縮板部にリード片を溶接して成るもので、該圧縮板部により、導電性や機械的強度の向上をしめると共に、これに溶接したリード片から電気を取り出すものである。図11にその製造工程の1例を示す。図11(a)は、例えば、発泡ニッケルから成る多孔性ニッケル電極基板Aの辺縁部に図12示の平坦な押圧面bをもつ押圧用治具Bにより、その少なくとも片面を加圧して圧縮板部aを形成する。次で該多孔性電極基板Aに例えば正極活物質合剤を充填し乾燥した後、加圧ロールにより加圧して所定の厚さに調製し、次で、該圧縮板部aに、ニッケル板

又はニッケルめっきを施した鉄板から成るリード片Cをスポット溶接又は超音波溶接などの溶接Dをすることにより、図11(c)及び図13示のペースト式電極板Pが得られる。尚、活物質合剤を充填した後は、その乾燥前又は後に、該圧縮板部aの表面に付着した活物質合剤は、ブラッシングにより或いは水又はエアの吹き付けにより除去する。

【0003】

【発明が解決しようとする課題】 上記従来の電池用極板Pは、該圧縮板部aの平坦面にリード片Cを溶接Dするので、その溶接部Dの剥離強度が比較的小さい。従って、極板群の組立工程などの作業工程でリード片に外力がかゝると該リード片Cは剥離することがしばしばあり、製造ロスを生ずる問題がある。また、該圧縮板部aは、多孔度の高い多孔性電極基板Aを圧縮したものであるため、機械的強度が比較的小さく、極板群の組立工程などで力がかゝるとひび割れ、破断を生ずることがある。また、上記の製造法において、活物質合剤を充填後、該圧縮板部aの外側には、該押圧用治具Bによる加圧圧縮により、該圧縮板部の平坦な板面を底面とする圧縮凹部が形成されるので、リード片Cを溶接すべきその圧縮凹部の平坦な底面の全面に付着した活物質合剤を完全に清浄除去しなければならず、作業が煩わしく、しばしば残留した活物質合剤がリード片Cとの溶接を邪魔して溶接不良をもたらす不都合があった。

【0004】

【課題を解決するための手段】 本発明は、上記の課題を解決し、圧縮板部に溶接したリード片の溶接部の剥離強度の増大と圧縮板部の強度の向上とをもたらす安定堅牢な電池用極板を提供するもので、極板の辺縁部の少なくとも片面に形成した圧縮板部にリード片を溶接して成る電池用極板において、該圧縮板部の板面を凹凸面に形成し、その凹凸面の凸部にリード片を溶接して成る。

【0005】 更に本発明は、上記の本発明の極板をもたらすと共に、活物質合剤の除去作業を容易にし得る1つの電池用極板の製造法を提供するもので、活物質合剤の充填された又はされてない多孔性基板の辺縁部の少なくとも片面を押圧面を凹凸面に形成された押圧用治具により加圧圧縮して圧縮板部の板面を凹凸面に形成した後、該圧縮板部の該凹凸面の凸部にリード片を溶接することを特徴とする。

【0006】 この製造法において、該押圧用治具の一対により、その多孔性基板の端縁部の両面を加圧圧縮することにより、圧縮板部の両板面を凹凸面に形成すれば一層の機械的強度の増大をもたらし、また、その圧縮板部の両板面のいずれか一方の凹凸面をリード片の溶接に利用できる。

【0007】 更に本発明は、上記の本発明の電池用極板をもたらすと共に、活物質合剤の除去作業を容易にし得る他の1つの電池用極板の製造法を提供するもので、活

物質合剤の充填された又はされていない少なくとも2枚の極板を切断により製造するに足る広面域を有する多孔性金属基板の少なくとも片面を平坦な押圧面を有する押圧用治具により加圧圧縮して圧縮板部を形成した後、該基板を加圧ロールを通して圧延することにより、該圧縮板部の平坦な板面を波形の凹凸面に形成し、次で該圧縮板部の中間部で切断して辺縁部に波形の凹凸面を有する圧縮板部を有する多孔性電極基板を複数枚形成し、その各多孔性電極基板の圧縮板部の波状の凹凸面の凸部にリード片を溶接することを特徴とする。

【0008】この場合、該押圧用治具の一対を使用し、これにより上記広面域を有する多孔性電極基板の所定個所の両面を加圧するようにし、その圧縮板部の両板面に波形の凹凸面を形成すれば、その両板面のいずれか一方の波形の凹凸面をリード片の溶接に利用し得られる。

【0009】

【発明の実施の形態】次に、本発明の実施例を添付図面を参照して説明する。図1乃至図4は、本発明の主としてアルカリ蓄電池に適用される電池用極板の製造法の1例と、これにより得られた電池用極板の1例を示す。図1(a)及び(b)は、本発明電池用極板の製造法を示す製造工程図を示す。図1(b)は、本発明の矩形状の電池用極板1の平面図、図4は、そのIV-IV線截断面図を示す。これらの図から明らかなように、本発明の電池用極板1は、活物質を充填された多孔性電極基板Aの辺縁部の片面を加圧圧縮して形成した圧縮板部2の板面を複数の凸部3aと凹部3bから成る凹凸面3に形成し、その凹凸面3の凸部3aにリード片4を溶接5して構成したものである。リード片4の該凹凸面3への溶接は、スポット溶接、超音波溶接などで溶接するが、その凸部3aに溶接されるので、従来の平坦な圧縮板部の板面が平坦面に溶接するに比し、単位面積当たりの加圧力は増大すると共に、電流密度も増大するので、小さい加圧力でても安定堅牢な溶接が得られ、リード片4の溶接部5の剥離強度は増大し、従来のような溶接不良の発生がなく、製品のロスなく高能率に製造し得られる。該リード片4は、ニッケル製などの金属製の肉薄で細幅のストリップ片から成り、該圧縮板部2の凹凸面3にその一端部を溶接されるが、図4示のように、その端部は、該圧縮板部2の外側に形成される該凹凸面3を底面とする圧縮凹部空間6内に収容されて、該極板1面から外部に突出する事がないので、その極板1面に積層されるセバレータを該リード片4により傷付けることがない。

【0010】該凹凸面3は、図3及び図4に明示のように、平行する複数の歓状の凸部3a、3a…とその間に平行する溝状の凹部3b、3bとから成る。該凹凸面3の形成は、上記極板の製造工程において、炭素繊維や金属繊維などの導電性のフェルト状電極基板や発泡ニッケル電極基板などの多孔度約95%以上の三次元構造の連続微孔を有する多孔性電極基板、図示の例では、発泡ニ

ッケル基板の辺縁部の片面を図2に示す押圧面7を、断面三角形山形の凸条7aと凹条7bとが交互に平行して形成された凹凸面7に形成された直方体の押圧治具8により加圧圧縮することにより、図3に明示のように、該圧縮板部2の板面が前記の歓状の凸部3aと溝状の凹部3bとが交互に平行した凹凸面3に形成され、同様にその外側に辺縁側が開放された凹部空間6が得られる。次に、該極板1の電極基板Aには、常法により、その製造工程で活物質合剤塗布充填機により活物質合剤が充填されている。例えば、正極板を製造するには、例えば、水酸化ニッケル粉から成る正極活物質粉を主体とし、導電剤としてニッケル粉、コバルト粉を混合したものにCMCなどの粘稠剤水溶液により混練して調製した活物質合剤を充填する。尚、押圧用治具8は、使用に当たり、これから突設した連結杆8aを介して、図示しない加圧機本体に連結されて使用される。

【0011】該圧縮板部2の表面には、活物質合剤が付着しているので、次で活物質合剤を充填された電極基板Aを加熱乾燥する前に或いは後に、ブラッシングや水や圧縮空気の吹き付けにより付着活物質を除去する。本発明によれば、該圧縮板部2の圧縮された側の板面3は、前記の凹凸面形状となって居り、而も、爾後、リード片4をその凸部3aのみに溶接すれば足りるので、その凸部3a、3aのみから付着活物質を除去すれば足り、その凹部に、活物質が残留したとしても、リード片4の溶接に何等悪影響を与えないでの、従来の圧縮板部の板面が平坦面である場合には、その全面を清浄する必要がある場合に比し、清浄作業を容易且つ迅速に行うことができ好ましい。

【0012】かくして、爾後、常法に従い、充填活物質合剤の加熱乾燥を行った後、図1(b)及び図4示のように、その圧縮板部2の凹凸板面3に、リード片4を溶接することにより、リード片4が良好に本発明の極板1が得られる。尚、該リード片4の該圧縮板部2への溶接は、活物質合剤の充填工程の前に行つても良いことは勿論である。

【0013】尚また、活物質合剤を充填、乾燥処理を終えた後は、前記のリード片4の溶接前に、一対の加圧ロールを通して加圧し、該基板を所定の厚さに調節することが一般であるが、リード片4の溶接後に加圧ロールを通して加圧しても差し支えない。

【0014】本発明によれば、該極板1の多孔性電極基板Aの辺縁部の両面を加圧圧縮して、圧縮板部2の両面に凹凸面3、3を形成し、そのいずれか一方の凹凸面3の凸部3aに、リード片4を溶接された極板1に構成しても良いことは勿論である。図5(a)はその製造法の1例を示し、図5(b)は、これによって得られた極板Aの先の実施例の図4に対応する要部の裁断図である。その製造法は、図5(a)に示すように、先の実施例で用いた押圧面を多数の平行する凸条7aと凹条7bを交

互に有する凹凸面7に形成された形式の押圧用治具8、8を該多孔性電極基板Aの辺縁部の両面に図示の例では、上下にその対向する押圧面7、7の対向する各凸条7aと凹条7bが該基板Aを介して噛み合うような位置に配設し、該基板Aの辺縁部の両面をこれら押圧用治具8、8で挾圧するように加圧圧縮する。然るときは、図5示の如き、波状に屈曲した圧縮板部2が得られて、従来の平坦な圧縮板部aに比し機械的強度が増大し、極板群の組立作業などにおいて外力を受けても亀裂や損傷を生せず、安定堅牢な極板が得られる。同時に、その波状の圧縮板部2により、その両面に実施例1と同様に平行する畝状凸部3a、3a、…と溝状凹部3b、3b、…が交互に有する凹凸面3、3が形成されると同時に、その夫々の外側に、圧縮凹部空間6が形成される。かくして、該圧縮板部2のそのいずれか一方の凹凸面3の凸部3a、3a、…にリード片4を溶接することにより、本発明の極板1が得られる。リード片4の溶接の前に、該多孔性電極基板Aに活物質合剤の充填と、該圧縮板部2に付着した活物質合剤の除去を行うことが一般であり、好ましいが、リード片4の溶接後に活物質合剤の充填を行うようにしても差し支えない。

【0015】図6は、本発明の極板の製造に使用する押圧用治具8'の変形例を示す。連結杆8a'を有する該治具8'は、その押圧面を、多数の四角錐状の点状凸部7a'、7aを縦横に整列配設し、これら各錐状の凸部7a'、7a'、…の間に多数の四角錐状の点状凹部7b'、7b'…が形成されて成る凹凸面7'に形成したものであり、かゝる凹凸面形状をもつ押圧用治具8'の一対を用意し、先の実施例の図5示の要領で、多孔性電極基板Aの辺縁部の両面を加圧圧縮することにより、図7示のように、圧縮板部2の両面に、該押圧用治具8'、8'の押圧面7'の四角錐状の点状凸部7a'、7a'、…と四角錐状の点状凹部7b、7b、…に対応する四角錐状の点状凹部3b、3b、…と四角錐状の点状凸部3a、3a、…が多数圧刻形成された凹凸面3、3が形成されると同時に、その外側に、圧縮凹部空間6、6が形成される。而して、その圧縮板部2のいずれか一方の凹凸面3を利用し、その凸部3a、3a、…にリード片(図示しない)を溶接することにより本発明の極板が得られる。

【0016】以上は、押圧面を凹凸面に形成されている押圧用治具を該多孔性電極基板Aの片縁部に加圧圧縮することによりその凹凸面をもつた圧縮板部を形成する作業は、通常、切断により少なくとも2枚の本発明の極板を製造するに足る広面域を有する長尺又はノ及び広幅の多孔性電極基板Aに適用することが好ましい。即ちその多孔性電極基板Aの長手の辺縁部に沿い所定間隔を存して該押圧用治具によりその少なくとも片面を順次加圧圧縮し凹凸面をもつ圧縮板部を所定間隔を存して形成するようにすることが、生産効率の点から好ましい。

【0017】図8は、本発明の極板の製造法の他の実施例を示す。この製造法では、上記の実施例に用いた押圧面を凹凸面に形成された押圧用治具を用いることなく、該多孔性電極基板Aに、凹凸面をもつ圧縮板部を形成することができる。即ち、切断により少なくとも2枚の本発明の電極を得るに足る広面域をもつ長尺又はノ及び広幅の多孔性電極基板を用意する。例えば、図8(a)示の如く、切断により2枚の本発明の電極を得るに足る長尺の所定の幅を有する大きさの多孔性電極基板Aを用意し、図8(b)示のように、仮想線で示す個所で切断し、その切断面を夫々一辺とする2枚の所定の大きさの極板を得る場合には、その予定の切断すべき仮想線と直交し、切断により夫々の極板の辺縁部に形成されるべき2枚分の圧縮板部を形成するに相当する2枚分の面域をもつ平坦な押圧面9をもつ図9示の押圧用治具10により、その基板の少なくとも片面を、その切断すべき仮想線に対し直交して等分に跨がる面域を加圧圧縮する。10aは、該押圧用治具10に設けた連結杆を示す。図示の例では、その電極基板Aの両面から、該押圧用治具9の一対を使用し、その上下から加圧圧縮して、その両面に図(a)示の如き2枚分の長矩形の2枚分の平坦な板面域から成る圧縮板部2とその外側に未圧縮基板厚により囲繞された1つの長矩形の圧縮凹部空間6を形成する。次で、該電極基板Aに正極活物質合剤を充填、乾燥した後、一対の圧延ロールを通してその長さ方向に加圧伸長する。然るときは、圧延ロールにより直接圧延される基板と圧延ロールにより直接圧延されない該圧縮板部2との圧延の差により、該圧縮板部2の平坦面には、図8(b)示及び図10示の如き波状に屈曲したその両面に夫々多数の平行する断面円弧状の凸条3aと凹条3bとから成る波状の或いは皺状の凹凸面3、3が形成される。同時にその圧縮板部2の両外側に圧縮凹部空間6、6が形成される。次に、その予定の切断線で切断するときは、図8(c)に示すように、電極基板Aの辺縁部に前記の波状の圧縮板部2の両面が凹凸面3、3に形成された活物質の充填された電極基板Aが得られる。活物質合剤の該電極基板Aへの充填は、該圧縮板部2の成形前又は後に行う。いずれの場合でも、而して、その各電極基板Aの該圧縮板部2の表面に付着している活物質合剤を除去した後、そのいずれか一方の凹凸面3の凸条、即ち凸部3a、3a、…にリード片4を溶接することにより2枚の本発明の極板1、1が得られる。

【0018】尚、多孔性金属基板への活物質合剤の充填は、本発明の凹凸面をもつ圧縮板部を形成する前に行い、その後、一部を加圧圧縮して圧縮板部を形成しても良いことは言うまでもない。また、リード片の溶接も、電極基板Aへ活物質合剤を充填する前又は後のいずれでもよい。

【0019】

【実施例】次に、更に詳細な実施例を説明する。

実施例1

厚さ1.6mm、13mm×37mmの多孔度95%のスponジ状Niシートから成る多孔性電極基板の辺縁部に、押圧面に多数の点状の凸部と凹部を配設した。押圧用治具によりその両面を加圧圧縮して3mm×3mmの圧縮板部とその両面に多数の点状凸部と点状凹部から成るを形成した後、重量比で水酸化ニッケル粉末93%、コバルト粉末4%、ニッケル粉末3%を所定量のCMC水溶液を加えて搅拌した活物質合剤ペーストを、充填機により該電極基板に充填し、150°Cで加熱乾燥した。再に、一対の圧延ロールを通して厚さ0.55mmに調製した極板を得た。次で、その圧縮板部の一方の凹凸面をブラシ掛けして付着している活物質合剤を除去した後、その凸部に、厚さ0.15mm程度のニッケル製テープ状のリード片をスポット溶接して本発明の極板を得た。

【0020】実施例2

厚さ1.6mm、13mm×74mmのスponジ状Niシートから成る多孔性電極基板の長さの中心の爾後切断すべき線を中心と交叉して、6mm×3mmの平坦な押圧面を有する押圧用治具の一対を用いて、該電極基板の両面を加圧圧縮し、その中心線の両側に等しく3mm×3mmの面域を有する圧縮板部を形成した。その後、該電極基板に、実施例1と同じ正極活物質合剤を充填、乾燥した。次で、該長尺の基板を、その長さ方向に一対の圧延ロールを通して加圧延伸処理を行い、該平坦な圧縮板部を波状に屈曲させ、その両面に多数の皺をもつ凹凸面を生成した。次に、その圧縮板部の中心線で切断し、辺縁部に該波状の圧縮板部が形成された2枚の活物質の充填された電極基板を得た。次で、その各基板の該圧縮板部のいずれか一方の波状凹凸面に付着している活物質合剤をブラシ掛けで除去した後、リード片をその凸部に溶接して本発明の極板を得た。

【0021】従来例

実施例1における押圧面を凹凸面とした押圧用治具に代え、従来の押圧面が平坦な押圧用治具を用いた以外は、実施例1と同様にして従来の極板を得た。

【0022】次に、上記の実施例1、2及び従来例の夫々の極板100枚につき、リード片のピールテストを行った。該ピールテストは、リード片と極板を引き剥がし、破断した時の引っ張り力により溶接強度を簡易的に測定した。(参考資料 産報出版発行 奥田淹夫著「スポット溶接入門」134、135ページ)。従来極板では、5枚が引張強度11.8N以下の不良品であった。因みに、100枚の平均引張強度は19.6Nであった。これに対し、本発明の極板は全て引張強度は大きく、不良品は0であった。因みに、各100枚の平均の引張強度は21.6Nであった。

【0023】

【発明の効果】本発明によれば、リード片を溶接すべき極板の圧縮板部の板面を凹凸面に形成し、その凸部にリード片を溶接するので、従来の圧縮板部の平坦面にリード片を溶接するに比し、小さい加圧力で而も電流密度が凸部に集中するので溶接が確実に得られ、より強固に溶接された極板が得られる。また、その圧縮板部の凹凸面は、押圧面を凹凸面に形成した押圧用治具により、多孔性電極基板面を加圧圧縮することにより簡単に形成でき、或いは長尺の基板に方形状の平坦な圧縮板部を形成後、該電極基板を圧延することにより自動的に皺状の凹凸面をもつ圧縮板部が得られる。而も、圧縮板部の凹凸面の凸部のみをブラッシングや空気や水の吹き付けによって付着活物質合剤を除去すれば足りるので、その除去作業が容易且つ高能率となる。

【図面の簡単な説明】

【図1(a) (b)】 本発明の電池用極板の製造法の1例の製造工程を示す平面図。

【図2】 本発明の製造法に用いる押圧用治具の斜面図。

【図3】 図1(a)の○で囲んだ要部の斜面図。

【図4】 図1(b)示の本発明の電池用極板の1例を示すI-V-I-V線截断面図。

【図5(a)】 本発明の製造法の変形例における製造工程の一部を示す断面図。

【図5(b)】 図5(a)の製造工程を経て得られた本発明電池用極板の要部の断面図。

【図6】 押圧用治具の変形例の斜面図。

【図7】 本発明の製造法の変形例における製造工程の一部の工程である図3に対応する要部の斜面図。

【図8(a)～(d)】 本発明の他の製造法の製造工程を示す平面図。

【図9】 図8示の製造法で使用される押圧用治具の斜面図。

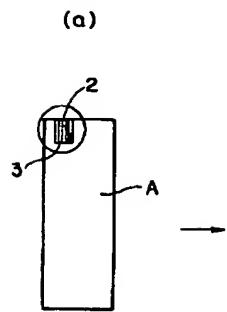
【図10】 本発明の電池用電極を示す図8(d)のX-X線截断面図。

【図11(a)～(c)】 従来の電池用極板の製造法の製造工程を示す平面図。

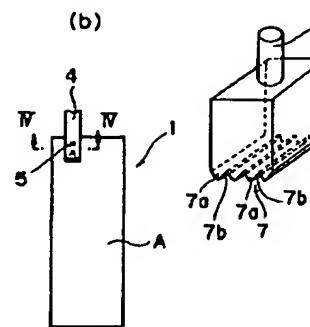
【符号の説明】

A 電極基板	1 本発明の電池用極板	2
圧縮板部		
3 凹凸面	3a 凸部	3
b 凹部		
4 リード片	5 溶接	6
凹部空間		
7, 7' 凹凸面を形成された押圧面		
8, 8' 押圧用治具	9 平坦な押圧面	1
0 押圧用治具		

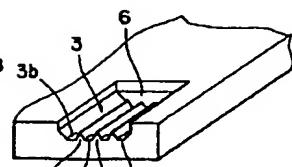
【図1】



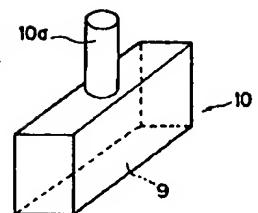
[图2]



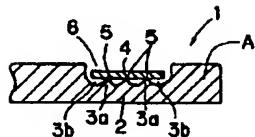
[図3]



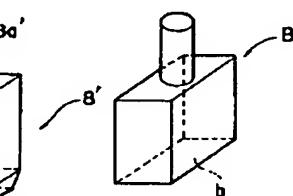
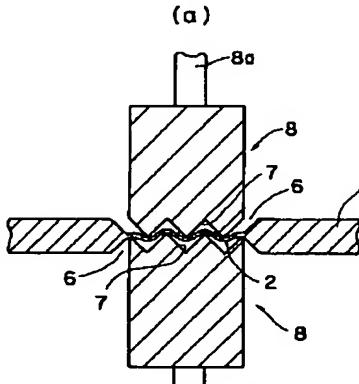
〔图9〕



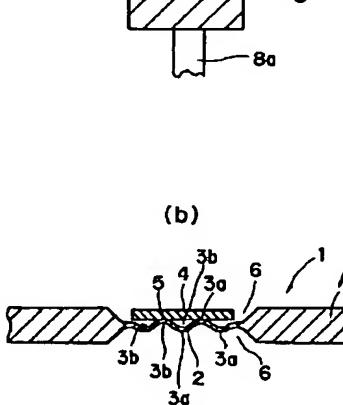
【图4】



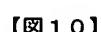
【图5】



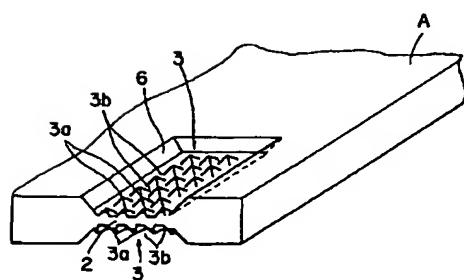
〔圖 8〕



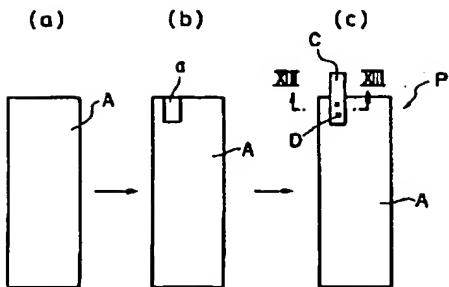
【図7】



[图 13]



【図11】



【手続補正書】

【提出日】平成7年12月18日

【手続補正1】

【補正対象書類名】明細書

【補正対象項目名】図面の簡単な説明

【補正方法】変更

【補正内容】

【図面の簡単な説明】

【図1 (a) (b)】本発明の電池用極板の製造法の1例の製造工程を示す平面図。

【図2】本発明の製造法に用いる押圧用治具の斜面図。

【図3】図1 (a) の○で囲んだ要部の斜面図。

【図4】図1 (b) 示の本発明の電池用極板の1例を示すI V-I V線截断面図。

【図5 (a)】本発明の製造法の変形例における製造工程の一部を示す断面図。

【図5 (b)】図5 (a) の製造工程を経て得られた本発明電池用極板の要部の断面図。

【図6】押圧用治具の変形例の斜面図。

【図7】本発明の製造法の変形例における製造工程の一部の工程である図3に対応する要部の斜面図。

【図8 (a) ~ (d)】本発明の他の製造法の製造工程を示す平面図。

【図9】図8示の製造法で使用される押圧用治具の斜面図。

【図10】本発明の電池用電極を示す図8 (d) のX-X線截断面図。

【図11 (a) ~ (c)】従来の電池用極板の製造法の製造工程を示す平面図。

【図12】従来の押圧用治具の斜面図。

【図13】従来のペースト式電極板の断面図。

【符号の説明】

A 電極基板	1 本発明の電池用極板	2
圧縮板部		
3 凹凸面	3 a 凸部	3
b 凹部		
4 リード片	5 溶接	6
	6 凹部空間	
7, 7' 凹凸面を形成された押圧面		
8, 8' 押圧用治具	9 平坦な押圧面	1
0 押圧用治具		

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